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water supply line 340 in this embodiment, the steam 303 may be generated by heating pure water stored in the tubular body 350 by the cartridge heater 345. Pure water can be stored in the tubular body 350 by closing the flow control valve 366. Upon the
5 detection of rise of water level in the tubular body 350 to the upper limit level, the upper limit level sensor 368 gives a signal to the control unit 356 and the control unit 356 controls a power source to supply power to the rubber heater 353 and the cartridge heater 354.

10 The steam supply line 342 is connected to an upper part of the steam generator 341 and is provided with a shutoff valve 375. A plate heater 376 is combined with the shutoff valve 375. The plate heater 376 is controlled by the control unit 356 for heat generation. A maximum heating temperature that can be
15 achieved by the plate heater 376 is, for example, 150 °C. A temperature sensor 377 and an overheat monitoring sensor 378 are connected to the plate heater 376. The temperature sensor 377 and the overheat monitoring sensor 378 are connected to the control unit 356. The heating operation of the plate heater 376
20 is controlled by the control unit 356.

The steam discharge line 380 provided with a shutoff valve 381 is connected to the steam supply line 342. The shutoff valve 381 is kept open until the temperature and the steam generating operation of the steam generator 341 are stabilized to discharge
25 the steam 303 into the mist trap 451.

A ribbon heater 382 is combined with the steam supply line 342. The ribbon heater 382 is controlled by the control unit 356 for heat generation. A heating temperature that can be achieved by the ribbon heater 382 is in the range of, for example, 90 to
30 120 °C. A temperature sensor 383 and an overheat monitoring sensor 384 are connected to the ribbon heater 382. The temperature sensor 383 and the overheat monitoring sensor 383 are connected to the control unit 356. The ribbon heater 382 is controlled by the control unit 356 for heat generation. The plate
35 heater 376 and the ribbon heater 382 heat the steam 303 being carried by the steam supply line 342 to prevent the condensation of the steam 303 in the steam supply line 342.

unit 461. The steam discharge line 380 and the first discharge line 457 are connected to an upper part of the mist trap 451. A first pipe 462 and a second pipe 463 are extended through the cooling unit 460 of the mist trap 451. The first pipe 462 is
5 connected to the steam discharge line 380 and the second pipe 463 is connected to the first discharge line 457. The pipes 462 and 463 open into the discharge unit 461. The pipes 462 and 463 are wound in a spiral shape in the cooling unit 460. The components of the mist trap 451 and the pipes 462 and 463 are
10 formed of a corrosion-resistant material, such as PFA (a copolymer of perfluoroalkoxyalkane and perfluoroalkylvinylether).

A cooling water supply line 465 for carrying cooling water and a cooling water discharge line 466 are connected to the cooling unit 460. As shown in Fig. 28, the cooling water supply line 465
15 is provided with a flow control valve 467, and the cooling water discharge line 466 is provided with a flow control valve 468.

A second discharge line 470 for discharging gases is connected to the discharge unit 461. Since the atmosphere in the processing vessel 302 contains the ozone gas 305, the second
20 discharge line 470 is provided with the ozone killer 452. The ozone killer 452 kills the ozone gas having a high ozone concentration and contained in the gas discharged through the second discharge line 470 by a catalytic reaction.

Cooling water is supplied through the cooling water supply
25 line 465 into the cooling unit 460 of the mist trap 451. The steam 303 and the pure water discharged from the steam generator 341 flow through the steam discharge line 380 into the mist trap 451. The pure water flows through the first pipe 462 into the discharge unit 461. The steam is cooled and condensed by the cooling water
30 while the same flows through the first pipe 462. Since the first pipe 462 is wound in a spiral shape, the steam takes a sufficient time for cooling by the cooling water to flow through the first pipe 462. Water drops formed by the condensation of the steam drops into the discharge unit 461. Liquid drops and the gas
35 discharged from the processing vessel 302 flow through the first discharge line 457 into the mist trap 451. The liquid drops discharged from the processing vessel 302 flows through the second

steam 303 and steam generating rate of the cartridge heater 354. The steam supplying nozzle 343 is set so as to eject the steam 303 toward an upper region in the processing vessel 302. The steam 303 ejected into the processing vessel 302 flows downward from the upper region in the processing vessel 302 and, consequently, the steam 303 can be satisfactorily applied to the wafers W.

Since the wafers W are heated at the temperature lower than the dew point of the steam 303, the steam 303 is condensed properly on the surfaces of the wafers W and a thin pure water film 31 can be formed on the surfaces of each wafer W as shown in Fig. 4. Then, the ozone gas 305 is supplied into the processing vessel 302 by the ozone gas supply unit 306 through the ozone gas supplying nozzle 392. The ozone gas 305 is ejected toward the upper region in the processing vessel 302 and flows downward from the upper region. Thus, the ozone gas 305 can be satisfactorily applied to the wafers W.

Thus the ozone gas 305 dissolves in the pure water films 31 to produce ozonic water films containing many oxygen radicals and hydrogen radicals on the surfaces of the wafers W. The oxygen radicals and the hydrogen radicals produced on the surfaces of the wafers W cause an oxidation reaction before the same disappear, whereby the resist forming the resist films 30 is decomposed into a carboxylic acid, carbon dioxide, water and such. Then, as shown in Fig. 5, the resist films 30 are oxidized and the resist forming the resist film is decomposed thoroughly by the ozonic water films and the resist films 30 are altered into water-soluble films 32. The water-soluble films 32 can be easily removed by a subsequent rinsing step using pure water.

After a predetermined processing time has passed, the supply of the steam 303 and the ozone gas 305 is stopped and cool air is ejected through the air supplying nozzle 404 into the processing vessel 302 in step S3. Consequently, the interior of the processing vessel 302 is cooled to an ordinary temperature to ensure a safe state for working. Then, the top cover 312 is removed and the wafers W are taken out of the processing vessel 302 to complete the process. Since the atmosphere around the processing vessel 302 is evacuated through the sink box 453, the

adjusting a temperature of an atmosphere in the processing vessel to a predetermined temperature;

adjusting a temperature of the substrate to a predetermined temperature; and

stabilizing the atmosphere at the predetermined temperature;

said steps being executed before said steps of supplying a vapor of the solvent into the processing vessel and supplying a process gas into the processing vessel.

27. The substrate processing method according to claim 13, further comprising the steps of:

heating the processing vessel;

heating an atmosphere in the processing vessel; and

stopping heating the atmosphere;

wherein the steps of supplying a vapor of the solvent into the processing vessel and supplying a process gas into the processing vessel are executed upon elapse of a predetermined time after completion of the step of stopping heating said atmosphere.

28. A substrate processing apparatus comprising:

a processing vessel defining a processing chamber in which substrates are processed;

a process gas supply section for supplying a process gas into the processing chamber in the processing vessel;

a solvent vapor supply section for supplying a vapor of a solvent into the processing chamber of the processing vessel; and

a substrate holding member for holding substrates in the processing chamber of the processing vessel.

29. The substrate processing apparatus according to claim 28, further comprising:

a substrate temperature controller for adjusting a temperature of the substrates held by the substrate holding member in the processing chamber.

30. The substrate processing apparatus according to claim 29, wherein the substrate temperature controller includes:

a heater incorporated on the processing vessel.